



**UNIVERSITI PUTRA MALAYSIA**

**THE EFFECT OF DIFFERENT POSTHARVEST TREATMENTS ON  
THE CHANGES IN THE PHYSICO-CHEMICAL CHARACTERISTICS  
AND MANIFESTATION OF CHILLING INJURY OF PISANG MAS  
(MUSASAPIENTUMVAR. MAS) DURING STORAGE AT LOW  
TEMPERATURE**

**DWI FEBRIMELI**

**FSMB 2000 1**

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**By**

**DWI FEBRIMELI**

**Thesis Submitted in Fulfilment of the Requirements for the  
Degree of Master of Science in the Faculty of  
Food Science and Biotechnology  
Universiti Putra Malaysia**

**January 2000**



*To my beloved parents.....*

Abstract of thesis presented to the Senate of Universiti Putra Malaysia in  
fulfilment of the requirements for the degree of Master of Science.

**THE EFFECT OF DIFFERENT POSTHARVEST TREATMENTS ON THE  
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By

**DWI FEBRIMELI**

**January 2000**

**Chairman: Associate Professor Azizah Osman, Ph.D**

**Faculty: Food Science and Biotechnology**

Preliminary studies on the effect of storage temperature and heat treatments on the physical characteristics were carried out on Pisang Mas (*Musa sapientum* var. Mas). Temperature  $14\pm1^{\circ}\text{C}$ ; 65-83%RH was the most suitable storage temperature for Pisang Mas with respect to peel colour score and texture as compared to temperature  $12^{\circ}\text{C}$  and  $15^{\circ}\text{C}$ . In contrast to peel colour score and pulp: peel ratio, fruit texture decreased significantly ( $P<0.05$ ) during storage. Heat treatments (hot air at 30, 40 and  $50^{\circ}\text{C}$  for 3 and 6 hours or dipping in hot water at  $50^{\circ}\text{C}$  for 2 minutes) reduced the manifestation of physical symptoms of chilling injury and extended the storage life of Pisang Mas by 2 weeks as compared to the control fruits. Effect of different postharvest heat treatments prior to low temperature storage were studied to reduce the manifestation of chilling injury of Pisang Mas during storage at low temperature and when held at ambient conditions thereafter. During low temperature

storage, untreated fruit were shown to have a significantly ( $P<0.05$ ) higher manifestation of chilling injury. Fruits exposed to 30°C hot air for 3 hours could significantly ( $P<0.05$ ) reduced chilling injury symptoms in Pisang Mas. Different postharvest heat treatments could not significantly extend the shelf life of Pisang Mas as compared to control. Peel colour, pulp colour, pulp: peel ratio, total soluble solids (TSS), titratable acidity (TA), TSS: TA ratio, total sugar, fructose, glucose and sucrose of fruit increased significantly ( $P<0.05$ ) during storage, in contrast to fruit firmness, pH, ascorbic acid (AA), tannin and starch contents. Chilling injury was also evident in all treated fruit after 2 and 4 weeks at low temperature storage followed by storage at ambient conditions. However, fruits kept for 4 week at low temperature (LTS) had a lesser extent of chilling injury as compared to fruit kept for 2 weeks at LTS. Fruits kept for 2 and 4 weeks under LTS had a shelf life of 9 and 6 days respectively. The TSS, TSS: TA ratio, pH and AA of fruit increased significantly ( $P<0.05$ ) for all treated fruits and control during storage. The firmness and starch content decreased significantly ( $P<0.05$ ). On the other hand, TA and tannin content were found to fluctuate during storage. Different concentrations of methyl jasmonate in reducing chilling injury were studied in Pisang Mas. Concentration higher than 100  $\mu\text{M}$  were found not to be significantly different in reducing symptoms of chilling injury. Although methyl jasmonate did not affect peel colour, nevertheless pulp colour was slightly affected. The TSS and pulp to peel ratio increased significantly ( $P<0.05$ ) during storage. However, firmness, AA, TA, pH, tannin, starch and pectin contents of fruit from all treatments were found to be inconsistent during storage.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia  
sebagai memenuhi keperluan untuk ijazah Master Sains.

**PENGARUH PERLAKUAN LEPAS TUAI YANG BERBEZA KE ATAS  
PERUBAHAN CIRI-CIRI FIZIKO-KIMIA DAN PERKEMBANGAN  
KECEDERAAN SEJUK DINGIN BUAH PISANG MAS (*MUSA SAPIENTUM*  
VAR. MAS) SEMASA PENYIMPANAN PADA SUHU RENDAH**

Oleh

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**January 2000**

**Pengerusi: Professor Madya Dr. Azizah Osman**

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Kajian awal terhadap kesan suhu penyimpanan dan perlakuan haba ke atas ciri-ciri fizikal Pisang Mas (*Musa sapientum* var.Mas) telah dijalankan. Suhu  $14\pm 1^{\circ}\text{C}$ : 65-85% RH adalah suhu penyimpanan yang paling sesuai untuk Pisang Mas berdasarkan skor warna kulit dan tekstur berbanding dengan suhu 12 dan  $15^{\circ}\text{C}$ . Manakala berbeza dengan skor warna kulit, nisbah isi kepada kulit dan tekstur buah berkurangan secara bererti ( $P<0.05$ ) semasa penyimpanan. Perlakuan haba (udara panas pada suhu 30, 40 dan  $50^{\circ}\text{C}$  untuk 3 dan 6 jam atau pencelupan dalam air panas pada suhu  $50^{\circ}\text{C}$  selama 2 minit) telah mengurangkan simptom fizikal kecederaan sejuk dingin dan memanjangkan hayat simpanan buah Pisang Mas kepada lebih 2 minggu berbanding kawalan. Pengaruh perlakuan haba yang berbeza sebelum penyimpanan telah dikaji untuk mengurangkan kecederaan sejuk dingin buah Pisang Mas (*Musa sapientum* var.Mas) semasa penyimpanan pada suhu rendah dan

selanjutnya disimpan pada suhu bilik. Semasa penyimpanan suhu rendah, buah yang tidak diperlakukan

bererti ( $P < 0.05$ ). Buah yang didedahkan kepada udara panas pada suhu  $30^{\circ}\text{C}$  untuk jangka masa 3 jam telah mengurangkan simptom fizikal kecederaan sejuk dingin secara bererti ( $P < 0.05$ ). Perlakuan haba yang berbeza tidak dapat memanjangkan hayat simpanan buah Pisang Mas berbanding kawalan. Warna kulit, warna isi, nisbah isi kepada kulit, jumlah pepejal terlarut, keasidan tertitrat, nisbah pepejal terlarut kepada keasidan tertitrat, jumlah gula, fruktosa, glukosa dan sukrosa telah meningkat secara bererti ( $P < 0.05$ ) semasa penyimpanan, berbeza dengan kekerasan buah, pH, asid askorbik, tannin dan kandungan kanji buah. Kecederaan sejuk dingin juga terjadi pada semua buah yang diperlakukan haba setelah disimpan selama 2 dan 4 minggu pada suhu rendah dan selanjutnya di simpan pada suhu bilik. Walau bagaimanapun, buah yang disimpan selama 4 minggu pada suhu rendah menunjukkan perkembangan kecederaan sejuk dingin yang paling rendah berbanding buah yang disimpan selama 2 minggu pada suhu rendah. Buah yang disimpan selama 2 dan 4 minggu pada suhu rendah mempunyai hayat simpanan 9 dan 6 hari masing-masing. Jumlah pepejal terlarut, nisbah pepejal terlarut kepada keasidan tertitrat, pH dan asid askorbik meningkat secara bererti ( $P < 0.05$ ) semasa penyimpanan untuk semua perlakuan haba dan kawalan. Manakala kekerasan buah dan kandungan kanji berkurangan secara bererti ( $P < 0.05$ ). Selain itu, keasidan tertitrat dan kandungan tannin didapati berubah-ubah semasa penyimpanan. Kepekatan methyl jasmonate yang berbeza untuk mengurangkan simptom fizikal kecederaan sejuk dingin juga telah dikaji pada Pisang Mas. Buah yang dicelup ke dalam  $10\text{ }\mu\text{M}$  menunjukkan skor kecederaan sejuk dingin yang paling tinggi. Kepekatan yang lebih dari  $100\text{ }\mu\text{M}$  didapati tidak memberi perbezaan yang bererti dalam mengurangkan simptom kecederaan sejuk dingin.

Perawatan methyl jasmonate tidak mempengaruhi warna kulit, tetapi memberikan sedikit kesan kepada warna isi. Jumlah pepejal terlarut dan nisbah isi kepada kulit meningkat secara bererti ( $P < 0.05$ ) semasa penyimpanan. Akan tetapi, bagi kesemua ujikaji, kekerasan, keasidan tertitrat, pH, asid askorbik, tannin, kandungan kanji, dan pektin telah didapati tidak konsisten semasa penyimpanan.



## ACKNOWLEDGEMENTS

Alhamdulillah, first of all I would like to express my utmost thanks and gratitude to the Almighty Allah, the Sustainer, the Most Gracious and Most Merciful, without Whose will no one can achieve anything, and my salawat and salam to His righteous messenger, prophet Muhammad S.A.W.

I would like to take this opportunity to express my appreciation and gratitude to the chairman of my Supervisory Committee, Assoc. Prof. Dr. Azizah Osman for her invaluable suggestion, guidance, discussion and patience throughout the project. I am also grateful to the other member of my supervisory committee, Assoc. Prof. Dr. Russly Abdul Rahman and Prof. Dr. Suhaila Mohammed for their constructive comments towards the project and preparation of this thesis.

My sincere gratitude is also extended to the financial support provided by the IRPA fund for this research, which was awarded to Assoc. Prof. Dr. Azizah Osman. I am also indebted to all the staff of the Dept. of Food Science for their generous cooperation. Acknowledgements is also due to all my housemates and friends, members of Perhimpunan Pelajar Indonesia (PPI) UPM and also laboratory assistants who had given me the moral encouragement and support to complete my graduate study. It is

impossible to list all their names here. I would like to extend my thanks to F.A.M.A. Muar Tangkak, Johore for their cooperation.

Finally, I also wish to express my deepest, appreciation to my beloved parents, sisters and brother who have given me encouragement and morally support in anyway during the many years of my seemingly never ending pursue for knowledge.

I certify that an Examination Committee met on 20 January, 2000 to conduct the final examination of Dwi Febrimeli on her Master of Science thesis entitled "The Effect of Different Postharvest Treatments on the Changes in the Physico-chemical Characteristics and Manifestation of Chilling Injury of Pisang Mas (*Musa sapientum* var. Mas) during Storage at Low Temperature" in accordance with Universiti Pertanian Malaysia (Higher Degree) Act 1980 and Universiti Pertanian Malaysia (Higher Degree) Regulations 1981. The Committee recommends that candidate be awarded the relevant degree. Members of the Examination Committee are as follows:

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## DECLARATION

I hereby declare that the thesis is based on my original work except for quotations and citation, which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at Universiti Putra Malaysia or other institutions.



**DWI FEBRIMELI**

Date: 14/3/2020

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